Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Section 2.106 of the	)	**ET Docket No. 95-18**
Commission's Rules to Allocate	)	
Spectrum at 2 GHz for Use by	)	
the Mobile-Satellite Service	)	

To: The Commission

COMMENTS OF BST, INC.

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February 3, 1999

SUMMARY

BST, Inc. ("BST"), one of the largest firms providing video and audio production services and research and development of video production equipment in the United States, and a licensee in the Local Television Transmission Service (LTTS), submits its Comments in response to the *Memorandum Opinion and Order and Third Notice of Proposed Rule Making and Order* (the Notice) released November 25, 1998. The Notice reaffirms the allocation of the 1990-2025 MHz and the 2165-2200 MHz bands to the Mobile Satellite Service (MSS) and proposes to reallocate 40 MHz of spectrum, at 2110-2150 MHz, to the Fixed and Mobile Services for assignment by auction. As an incident of these actions, the Commission proposes to change the Broadcast Auxiliary Service (BAS) allocation from the 2025-2130 MHz segment to the 2025-2110 MHz band. BST's comments address the interests of Commission licensees in the LTTS and those engaged in video production in the 2 GHz band.

The actions taken in this proceeding must guarantee the continuity of LTTS video production service, in order to continue to fulfill the viewing expectations and the current level of service being provided by customers of BST to the American public. Besides providing high-quality programming for news and sporting events, LTTS companies also provide time-sensitive and critical pictures of natural and man-made disasters, and bring events into the American homes. These important services must not be threatened or degraded. The Commission, in this proceeding, must do three things: (1) it must provide replacement spectrum for the 35 MHz lost to MSS; (2) it must provide a reasonably long transition time for conversion to any narrower channel spacing at 2025-2110 MHz; and (3) it must provide a firm plan for payment to LTTS licensees of displacement costs *in advance of any changeover* from use of 17 MHz bandwidth channels to narrower-bandwidth channels. LTTS service must be considered separately for purposes of cost reimbursement for displacement, as displacement comes to BST at a far higher cost than to most Part 74 BAS users. The Commission must appreciate the unique circumstances applicable to LTTS video production companies, and provide these small businesses with advance reimbursement costs to permit seamless service to customers and the level of service now being provided. The Commission finally should commence a proceeding to consider the long term spectrum sharing needs of multichannel LTTS video production, and the means by which, in the longer term, such service can be continued without disruption to primary users of microwave spectrum.

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Now comes BST, Inc. ("BST"), one of the largest firms providing video and audio production services and research and development of video production equipment in the United States, and a licensee in the Local Television Transmission Service (LTTS), by counsel and pursuant to Section 1.415 of the Commission's Rules (47 C.F.R. §1.415), hereby respectfully submits its Comments in response to the *Memorandum Opinion and Order and Third Notice of Proposed Rule Making and Order* (the Notice) released November 25, 1998. The Notice reaffirms the allocation of the 1990-2025 MHz and the 2165-2200 MHz bands to the Mobile Satellite Service (MSS) and proposes to reallocate 40 MHz of spectrum, at 2110-2150 MHz, to the Fixed and Mobile Services for assignment by auction. As an incident of these actions, the Commission proposes to change the Broadcast Auxiliary Service (BAS) allocation from the 2025-2130 MHz segment to the 2025-2110 MHz band. Finally, the Notice proposes to add Government space operations (Earth-to-space and space-to-space), Earth exploration satellite (Earth-to-space and space-to-space) and space Research (Earth-to-space and space-to-space) in the same BAS band at 2025-2110 MHz on a co-primary basis. In the interests of Commission

licensees in the LTTS and those engaged in video production, BST states as follows:

I. Introduction and Background

1. The Commission has not indicated, in the Notice or otherwise, any degree of understanding of the nature of television program production in the United States, or specifically the difficulties encountered by LTTS licensees in providing sports program production that television viewers in the United States have come to expect and demand. This proceeding stands to determine the fundamental ability of video production companies to provide services to broadcast licensees and other video delivery service providers. It offers as well a good opportunity for the Commission to understand the nature of the business, and thereby gain an appreciation of the difficult regulatory circumstances under which video production companies must practice their profession. Video production companies provide professional technical service to broadcast licensees, broadcast networks, cable networks, other cable entities, and others, in program production. BST has pioneered the field of high-technology video production at sporting events, and motor sports competition in particular. BST, for example, designs, develops, and produces RF cameras and transmitters for installation in race cars at Indianapolis, NASCAR races, and at other preeminent automobile racing events. It also provides video and audio production services for golf competitions and other events of national importance. The services are complex, and require a far greater degree of RF engineering than does most electronic news gathering (ENG). As such, the services are far more difficult to accomplish than would a typical remote ENG broadcasts, which are done daily by Part 74 broadcast licensees.

2. A description of the type of use made of the 2 GHz BAS band and other frequencies by BST is illustrative of the overwhelming problem posed by this proceeding. At the

Indianapolis 500 automobile race, viewers are accustomed to seeing in-car video during the race. BST has developed miniature RF cameras, approximately 14 of which are located in different race cars during the race. These devices, during the race, each transmit low-power video signals (one channel per RF camera) to one or more helicopters hovering above the race course, which relay the signals to a production truck on the ground nearby. Up to eight different video channels, each 17 MHz wide, are used in uplink and downlink configurations, in parallel paths. In addition, there is video shot from the pit areas, and from the helicopters themselves, which is transmitted to the production truck. Currently, the frequencies used to relay video from the multiple, moving race cars to the airborne helicopter must be done at or near the 2 GHz BAS band. The 17 MHz-wide channels are currently necessary, and even at that bandwidth, since the race car RF cameras are each transmitting in parallel paths to the helicopter, there is adjacent-channel interference received. Other BAS/LTTS bands are in use for stationary video shots from the pit and staging areas, but those are not adequate for car to helicopter paths.

3. Providing the type of video and audio from other sporting events is equally challenging. The America's Cup yacht race, for example, necessitated the use of RF cameras on numerous boats, the signals from which are uplinked to helicopters and relayed to shore production vehicles. The movement of the boats, and the instability of the helicopter platforms, makes the equipment difficult to design, and the video difficult to produce. The 2 GHz band is critical for this application. The present level of service is expected by the viewing public in each case, and it is an essential component of the high quality of television in the United States. At any given itinerant location, especially automobile races, there are more RF cameras in use, and more channels needed, than are available at 2 GHz. BST has been able to provide the level

of service needed for the event solely by means of special temporary authorizations and experimental authorizations in nearby bands, especially at 2.3 GHz.[1] However, the Commission's recent reallocation decisions involving the 2300-2360 MHz band stand to preclude future use of those bands for video production, even on a temporary, itinerant basis. Even had no changes been made in the 1990-2110 MHz band, companies such as BST will be unable in the near future to provide the increasing level of video service that is called for by the broadcast networks and other customers that BST serves, and which the viewing public demands. Due to the substantial bandwidths needed for video production, and the itinerant nature of the service provided, there is no possibility of leasing channels from common carriers for this purpose.

4. The situation is made even more complicated by the fact that video production companies are not the primary users of the 2 GHz frequencies. Part 74 licensees use the 2 GHz band extensively, on a regular basis, for electronic news gathering (ENG) and in some cases for fixed links. LTTS licensees are authorized to use all seven, 17 megahertz wide channels in the 1990-2110 MHz band now, but must do so on a shared basis with broadcast licensees, who often utilize higher power at the same geographic locations at which BST operates. BST and other responsible LTTS licensees are extremely careful to contact the local frequency coordinator of the Society of Broadcast Engineers before commencing operation at 2 GHz at any location, but not all BAS licensees or LTTS licensees are as careful. Because there are far more users than there are channels at 1990-2110 MHz, interference is inevitably suffered by all concerned unless SBE frequency coordination is conducted by all users.

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[1] The Office of Engineering and Technology, especially the Experimental Authorizations Branch, has been exceptionally accommodating in this respect, and is to be complimented for its understanding of the unique concerns and needs of BST.

II. The Notice Proposal Fails to Reaccommodate Displaced LTTS Licensees

5. What is proposed by the Commission now, since it has chosen not to revisit the allocation of 1990-2025 MHz to MSS made in the *First Report and Order and Further Notice of Proposed Rule Making*, 12 FCC Rcd. 7388 (1997)(First R&O/FNPRM) in this proceeding, and given the requirements of the 1997 Budget Act, is to shrink the 2 GHz band from 120 MHz to a total of 85 MHz. This would, according to the Commission's proposal, cause a reduction in the bandwidth of each of the current seven channels to approximately 12 MHz. This creates several problems, some unique to video production entities such as BST, and others shared between LTTS and BAS users. The Commission, in this proceeding, in order to effectuate this proposal, must do three things: (1) it must provide replacement spectrum for the 35 MHz lost to MSS; (2) it must provide a reasonably long transition time for conversion to narrower channel spacing at 2025-2110 MHz; and (3) it must provide a firm plan for payment to LTTS licensees of displacement costs *in advance of any changeover* from use of 17 MHz bandwidth channels to narrower-bandwidth channels.

III. A Twelve Megahertz Bandwidth at 2 GHz is Insufficient for LTTS Video Production

6. The Commission has chosen in the instant Notice to preserve for MSS the entire 1990-2025 MHz and 2165-2200 MHz allocations previously made, and to visit all of the adverse effects of the 1997 Budget Act on BAS and LTTS users. At the time the MSS allocation was created earlier in this proceeding, however (in the First R&O/FNPRM), recognized that the exact same reduction in the BAS allocation would work a significant hardship on BAS spectrum

users, including BAS and LTTS licensees[2] which heavily use the 1990-2110 MHz band. There, the Commission stated, in relevant part:

> As indicated above, the 1990-2025 MHz band is part of the 1990-2110 MHz band that is currently allocated to BAS, CARS and LTTS. We reiterate that for this proceeding, we will collectively term these services BAS, and any changes in our regulatory structure applicable to BAS will be equally applicable to CARS and LTTS. We will treat CARS and LTTS in the same manner as BAS because both CARS and LTTS are authorized users of the 1990-2025 MHz band, and have invested in equipment to use the band, as has BAS. In the Notice, we observed that sharing between MSS and BAS is not feasible. We therefore proposed to add 35 megahertz of spectrum to the upper end of the BAS band at 2110-2145 MHz and to relocate BAS incumbents currently occupying 1990-2025 MHz to 2110-2145 MHz. This proposal would provide BAS with the same amount of spectrum that it currently has. As possible alternatives, we inquired into the feasibility of requiring BAS incumbents to adopt a more spectrally efficient technology to operate in the remaining 85 megahertz at 2025-2110 MHz, or into the feasibility of moving all BAS operations to a higher frequency band. We further proposed requiring MSS providers to bear the cost of relocating the BAS incumbents.
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> 12 FCC Rcd. at 7396 (footnotes omitted)

7. Based on the comments, the Commission held that the current 17- and 18-megahertz wide channels could be narrowed somewhat, based on advances in radio technology. Contribution-quality signals in somewhat narrower channels could be provided. However, the Commission specifically held that 12 or 13 megahertz wide channels would **not** be sufficient:

> ...we do not agree with the position of the MSS community that we should reduce BAS to 12- and 13-megahertz channels and mandate a switch to digital transmission. *We believe that a reduction of five megahertz per channel is too severe to permit FM analog contribution-quality BAS signals*, and we do not believe that this is the appropriate proceeding to determine whether or when BAS should convert to digital format in conjunction with the development of digital television...We conclude that the best solution for BAS relocation is to reduce the

[2] The Commission stated that "(t)he 1990-2025 MHz band is part of the 1990-2110 MHz band that is currently allocated for and used heavily by BAS, and is also authorized for use by CARS and the LTTS." 12 FCC Rcd at 7391.

> BAS band at 2 GHz from 120 to 105 megahertz, and relocate the band from 1990-2110 to 2025-2130 MHz. This would allow the resultant BAS band to be divided into seven channels of 15 megahertz each, thus retaining the current capacity of the BAS band...
>
> *****
>
> Relocating BAS will require retuning of BAS equipment, and in many if not most cases replacing equipment or retrofitting equipment to allow improved intermediate frequency bandpass and adjacent-channel rejection, as pointed out by SBE...We do not foresee that there will be any need physically to relocate or rebuild any facilities. We are confident that the reaccommodation of BAS operations can be accomplished by simply replacing or retrofitting any current equipment. The cost of all steps necessary for clearing the 1990-2025 MHz band for MSS operations will be borne by MSS operators...
>
> 12 FCC Rcd. at 7401-2 (footnotes omitted)

8. BST realizes that the Commission was somewhat hamstrung by the ill-advised decision of Congress to substitute its judgment for that of the Commission in the area of spectrum allocations in the 1997 Budget Act. It is virtually certain that Congress had an inadequate appreciation of the ramifications of the spectrum auction provisions in that legislation. However, the Commission in the instant Notice has, less than two years after specifically finding that 12 or 13 MHz channels for BAS/LTTS were ***not*** workable, proposed to mandate exactly that. It does so based on citation of one study,[3] which has apparently not been subject to critical industry analysis.The Commission stated:

> Studies and information that have become available since the adoption of the *First R&O/Further Notice* indicate that it is possible to transmit FM analog BAS signals in channels as narrow as 12 megahertz and digital BAS signals in channels as narrow as 10 megahertz. An allocation of 85 megahertz for BAS could provide six channels of 12 megahertz, and one of 13 megahertz, for BAS operations. This would appear to satisfy BAS needs for seven distinct channels. Given the requirements of the 1997 Budget Act and other demands for allocations in this

[3] See, *Digital Video Microwave Systems for STL and ENG: Applications and Test Results* (Payne, 1998), as cited in the Notice, at footnote 66.

> region of the spectrum, we are proposing to reallocate 85 megahertz of spectrum for BAS at 2025-2110 MHz. We invite comment on the feasibility of the proposed BAS allocation and on any other alternate allocations or measures that would mitigate the impact to BAS of the reallocations of BAS spectrum to other services.
>
> Notice, at paragraph 32.

9. The fact is, LTTS licensees such as BST, which utilize up to eight parallel paths for both uplinking and downlinking video at a sporting event, over short distances on adjacent channels, cannot presently utilize 12 or 13 megahertz wide channels. Even the current 17 megahertz wide channels suffer interference due to the necessary use of multiple, adjacent channels along parallel paths. Narrowing the channels to 12 megahertz each will inevitably result in the inability of LTTS users to utilize more than a very few of the channels in the BAS band at once. Not only would all of the more than eighty, unique 2 GHz transmitters designed and built by BST need to be replaced, at a cost of approximately $15,000 per transmitter, it is not possible to adequately redesign these transmitters at the present. Even if it proves possible in the longer term, all of the research and development costs of BST's current custom-designed and manufactured equipment, which is absolutely unique, would be sacrificed. BST's LTTS operations are thus far different from a typical Part 74 licensee, which typically uses one 2 GHz channel at a time, per geographic remote location, for ENG purposes.

IV. The Commission Must Provide Replacement Spectrum for LTTS Video Production

10. Therefore, for LTTS licensees especially, the Commission must provide some replacement spectrum for video channels in the same frequency range, and it should permit bandwidths of at least 15 MHz per channel. The 6/7 and 13 GHz BAS bands, which are available to LTTS licensees as well as to BAS licensees, are not suitable substitutes for 2 GHz.

First of all, the 6 and 7 GHz BAS allocations, and to almost the same extent, the 13 GHz bands, are occupied with STL and fixed Part 74 facilities. Second, BST is already making use of the 7 GHz band for video production on location at sporting events. Third, and most importantly, however, based on extensive testing and experience, frequency bands above 5 GHz cannot be used effectively for LTTS video production at car racing, yacht racing, or other sporting event video production, without using elaborate (and very expensive) antenna tracking systems not now in use or on hand.

11. The Notice does not indicate that the Commission has even considered replacement spectrum between 1 and 5 GHz to accommodate displaced LTTS or BAS users, so as to permit retention of seven channels, each at least 15 megahertz bandwidth. Yet, the Commission proposes to mandate a firm transition date by which all BAS, CARS and LTTS licensees would have to convert to narrower bandwidth. BST requests that the Commission revisit the issue of equivalent replacement spectrum, since it is not clear that conversion to 12 megahertz bandwidth is possible for LTTS licensees. BST is currently experimenting with encoding of audio into the video channel, which will allow some compression, but the results of that work will not be known for at least six months, and more probably up to a year. If, due to bandwidth compression, BST finds that it cannot any longer utilize the 2 GHz band in 12 or 13 MHz bandwidth channels, it will, due to that displacement, have to acquire extensive new equipment, including replacement antennas, antenna tracking equipment for the helicopters, and other equipment, which will significantly increase the cost of the equipment.

12. Notwithstanding the foregoing, one notable, and uniquely favorable, characteristic about LTTS video production technology, which is different from much typical Part 74 BAS

operation, is the capacity to share spectrum on a coordinated basis with other users of the same spectrum. BST's LTTS operations at sporting events are short-term, itinerant uses in every case, usually not more than a few days. Given the nature of its operation, it can operate with no perceptible interference to other users nearby. Its video uplinking and downlinking from helicopters is at exceptionally low power, using narrow-beamwidth antennas. BST regularly utilizes spectrum at 2.3 GHz on a coordinated basis with aeronautical flight test telemetry, though the coordination fees charged by those entities are burdensome. Given the ability of LTTS video production to share with incumbent users, the Commission could, and should, authorize LTTS licensees to utilize bands recently reallocated by NTIA for private sector use, on a secondary basis to incumbent users. Specifically, the Commission should modify Parts 2 and 101 regulations in this proceeding to make the bands 3650-3700 MHz, and 4635-4685 MHz available for LTTS operation as replacement spectrum on a non-interference basis to incumbent users, and those who might make use of those bands following competitive bidding license assignment.

V. Any 2 GHz Transition Period Must Account for Small Businesses

13. BST would, of course, prefer no net loss of the existing 120 MHz of 2 GHz BAS spectrum, or alternatively that replacement spectrum in another band be provided. However, if the Commission should decide, notwithstanding the arguments herein, that the 2 GHz BAS/LTTS band be limited to 85 MHz of spectrum, refarmed into seven similar-bandwidth channels, it is agreed that all BAS and LTTS licensees could not continue to operate with on 17-MHz wide channels within the reduced 85 MHz. Such operation would most assuredly lead to interference and confusion between and among LTTS licensees, TV broadcast stations, TV network users,

and cable network users. BST also concurs with the tentative Commission decision to require simultaneous retuning or replacement of all 2 GHz BAS and LTTS equipment nationwide on or by a date certain, provided that MSS entities fund this conversion in advance.

14. BST is a small business, within the Federal definition thereof, and cannot be expected to redesign, reconfigure and remanufacture its entire inventory of more than eighty transmitters and more than forty receivers without payment of compensation in advance of the conversion. Advance payment by MSS displacing entities ensures that BST will not be left "holding the bag" should the MSS licensees default on their compensation obligations prior to the completion of a phased-in approach. MSS users are, by their nature, world-wide in scope, and once an MSS service provider has commenced operation, it will be impossible to restrict operation only to those portions of the United States where BAS and LTTS users have converted to a new band plan. Therefore, a market-by-market, or geographically-based LTTS/BAS transition plan overlapping with MSS startup would likely fail.

15. BST has ongoing obligations to video production customers, and must satisfy the expectations of the viewing public. As a practical matter, the transition plan must be carefully orchestrated to maintain interoperability in adjacent and overlapping markets. Any transition date must reflect the continuing operational needs of the LTTS and BAS users which are relinquishing spectrum, and the entire burden must be visited on MSS users entering the spectrum. The timetable must be identical for all BAS and LTTS users, because otherwise, BST would have to maintain and transport two sets of equipment, one set for the new band plan and the other set for the old band plan, which would not be practical or economically possible. Furthermore, the lead time for any channel bandwidth conversion or frequency change would have to be

substantial, on the order of two years.

16. BST agrees that a nationwide change over by a date certain will place a burden on equipment manufacturers, LTTS licensees, broadcasters, and MSS licensees alike, but it is a necessity that will have been created by the reallocation of this band in particular. If the MSS licensees are unwilling, or unable, to fund the cost of first relocating all incumbent users, given the unique disaccommodation suffered by LTTS licensees at 2 GHz, then under the Commission's Emerging Technologies policy, MSS licensees should not be permitted to commence operations.

17. The Commission proposes to defer to BAS and LTTS licensees the business decision during negotiations as to whether it is most economical and efficient to retune existing BAS equipment or buy new equipment. This is not an option with respect to BST and some other LTTS licensees. BST's equipment is unique, and must be both redesigned, and replaced. Some of the more than forty receivers used by BST can be retuned to the new and perhaps narrower channels, but this would have to include narrowing the intermediate frequency (IF) portion of the radios as well, as it is the IF portion of a receiver that provides the receiver selectivity; if only the center frequencies were changed, there would be massive interference because the existing and wider receiver IF bandpass would be unable to reject adjacent-channel transmissions using the new band plan.

18. Indeed, there are many unanswered questions regarding digital LTTS equipment, including size, weight, and power consumption issues; the ability of digitally-modulated signals to perform in interference-limited environments requiring sharp bandpass filters; latency concerns; lockup times after temporary signal loss; and the need for contribution quality rather

than just distribution quality feeds and whether heavily compressed digital signals can provide such quality. Given the impossibility of a timely transition, and the need for MSS entities to fund the acquisition of replacement hardware for LTTS licensees, BST urges that the Commission impose a conservative, mandatory transition plan to ensure that MSS licensees honor their obligations. A negotiation time frame cannot be established at the present time, but in any case, the transition date cannot be earlier than two years from the date of finality of the Report and Order in this proceeding, and provided that the MSS funding for LTTS and BAS displacement is available by then.

VI. The Commission Must Consider LTTS Separately from BAS In Terms of Displaced User Compensation

19. Regardless of which entity is identified to administer the transition, (it is understood the BAS licensees would prefer that the National Association of Broadcasters (NAB) serve that function), LTTS companies such as BST, which utilize these bands and develop equipment which is far different from typical BAS equipment, should be considered separately. With regard to criteria for gauging the acceptability of replacement LTTS equipment, BST suggests that all replacements or modifications that implement the new band plan, whether or not they add new design capabilities, should be deemed justified and acceptable. BST's reasonable design costs for new equipment should be reimbursable. It is anticipated that redesign, reconfiguration, and remanufacture of each of the LTTS 2 GHz transmitters made by BST will cost approximately $15,000, for a total of $1.2 million, and that the retuning of the receivers will cost, in the aggregate, approximately $200,000. If new bands are provided at frequencies significantly higher than 2 GHz, new antennas and antenna tracking equipment will have to be purchased, and that must be reimbursable as well. These costs are far too high to be advanced by BST, and funding

for the transition must be made significantly in advance of the transition date.

20. The Cost of conversion to digital LTTS equipment must be considered. For example, highly portable digital equipment for point-of-view use will simply not be available within any time frame which could be considered in any near term transition schedule. By contrast, digital radios for permanent fixed uses are available now in similar frequency bands. Some fixed relay links will have to carry additional audio and/or data channels that simply cannot fit within 12 MHz in an analog format under any reasonable timetable. Highly portable applications will have to make two transitions: one immediately, with continued use of FM video analog modulation, and a second conversion when digitally-modulated radios become small enough to be practical substitutes; this is only likely to occur after several generations of increasingly more compact and sophisticated digitally-modulated radios, and is probably at least five to ten years in the future.

VII. Conclusions

21. The actions taken in this proceeding must guarantee the continuity of LTTS video production service, in order to continue to fulfill the viewing expectations and the current level of service being provided by customers of BST to the American public. Besides providing high-quality programming for news and sporting events, LTTS companies also provide time-sensitive and critical pictures of natural and man-made disasters, and bring events into the American homes. These important services must not be threatened or degraded. The Commission, in this proceeding, must do three things: (1) it must provide replacement spectrum for the 35 MHz lost to MSS; (2) it must provide a reasonably long transition time for conversion to any narrower channel spacing at 2025-2110 MHz; and (3) it must provide a firm plan for

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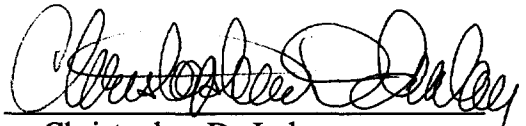
Respectfully submitted,

BST, Inc.

By 

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